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HOW to Identify and Manage Ash Yellows in Forest Stands and Home Landscapes

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Introduction

Ash yellows is a recently discovered disease that causes slow growth and decline of ash (*Fraxinus*) species. Ash yellows went undetected until the 1980's because its symptoms were not differentiated from those of decline caused by adverse environmental factors such as drought, shallow soils, flooding, or parasitism by opportunistic fungi. Current knowledge supports the theory that ash decline can result from various causes, and ash yellows can be, but is not always, a causal factor.

Ash yellows is caused by wall-less microbes called mycoplasmalike organisms (MLOs) which invade the tree systemically (phloem sieve tubes) and are presumed to be transmitted by leafhoppers or related insects. White ash (*F. americana*) and green ash (*F. pennsylvanica*) are the most frequently affected species.

The impact of ash yellows on ash populations is not well documented. Individual trees in which the disease is discovered are likely to show declining growth and, often, dieback (Cover photo and Figure 1). The disease occurs in woodlots and forests, home landscapes, and urban plantings.

Figure 1. White ash with declining growth and crown dieback.

Distribution and Host Range

Ash yellows has been reported only in North America. The main range of the disease includes parts of 16 northeastern and midwestern states and the southernmost portions of the Canadian provinces of Ontario and Quebec (Figure 2). Ash yellows has also been found in two southwestern locations. In addition to white ash (*F. americana)* and green ash (*F. pennsylvanica*), ten other ash species including blue ash (*F. quadrangulata)*, black ash (*F. nigra*), and velvet ash (*F. velutina*) are also reported hosts.

Ash yellows MLOs also cause lilac witches'-broom, a decline-type disease that has been diagnosed in at least 35 lilac taxa. Ash yellows MLOs have not been detected in naturally infected plants other than ash and lilac.

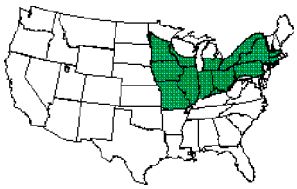

Figure 2. Known distribution of ash yellows, 1994.

Symptoms

Symptoms of ash yellows vary with ash species. White ash sustains permanent and often rapid decline in tree growth. Slow twig growth and short internodes can cause foliage to appear tufted at tips of twigs and the crown to appear more transparent than normal (Cover photo and Figure 3). Subnormal leaf size and light green leaf color, upturned leaf margins, and premature fall coloration are common. Deliquescent branching (loss of apically dominant growth habit) on slowly growing lateral branches may also occur (Figure 4). Eventually a progressive dieback of branches begins and witches'-brooms may

Figure 3. Tufted foliage at tips of twigs and crown thining.

Figure 4. Deliquescent branching showing loss of apically dominant growth on slowly growing lateral branches.

Figure 5. Witches'-brooms are clusters of upright spindly shoots.

Figure 6. Witches'-brooms and vertical crack on trunk near the ground.

develop at the trunk base (Figure 5). Witches-brooms are clusters of upright spindly shoots. Vertical cracks and cankers are common on the trunk near the ground (Figure 6).

Witches-brooms usually develop near the soil line but occasionally are found several feet up the trunk. Brooms may produce simple leaves or dwarfed compound leaves with fewer than the normal 5 to 9 leaflets (Figure 7). Interveinal chlorosis (yellowing) is common on foliage of brooms. On white ash, brooms occur most often on trees with severe dieback, on suppressed saplings (Figure 8), and on stumps of diseased trees.

Green ash exhibit symptoms similar to white ash but appear to sustain less dieback and sometimes produce witches-brooms without other distinctive symptoms (Figure 9). Radial growth loss associated with MLO infection has been detected in green ash.

Figure 7. Shoot with simple leaves.

Figure 8. Witches'-brooms on white ash sapling.

Figure 9. Green ash sometimes produce witches'-brooms without other distinctive symptoms.

Diagnosis

Field

Field diagnosis of ash yellows is sometimes difficult. Reduced growth, deliquescent branching (Figure 4), and progressive decline are typical symptoms of ash yellows but can also result from other factors such as poor site conditions, drought stress, freezing and flooding damage, mechanical or chemical injuries, insect attack, and parasitism by opportunistic fungi.

Witches'-brooms are diagnostic, but only a small percentage of infected trees display this symptom at a given time. To assess a stand for the presence of ash yellows, inspect suppressed saplings and stumps, particularly along the edges of the stand, for the witches-brooms. If ash yellows is present, careful inspection will usually reveal at least one tree or stump with a broom. If brooms are found, then trees showing deliquescent branching may be assumed to have ash yellows.

If numerous ash in a stand have ash yellows, the disease typically interferes with stand productivity. It is not critical to learn which individual trees are infected, however, because ash yellows commonly occurs in conjunction with slow growth and decline caused by adverse environments.

Laboratory
A standard microscopic test is available to detect MLOs in ash phloem tissue but requires a flourescence microscope. Microscopic testing is required for diagnosis of the disease in most individual or landscape trees, but careful field survey is nearly as effective as microscopic testing for detection of the disease in a stand or woodlot.

DNA analysis techniques have been developed which are specific for the identification of the ash yellows MLOs. Specific diagnosis is not necessary for most field circumstances, however.

Disease Cycle

Little is known about the disease cycle of ash yellows. The causal MLOs are presumed to be spread by insect vectors such as leafhoppers, because these insects are the most common vectors of MLOs causing other plant diseases. Symptoms develop 0-3 years after MLOs are detected in ash phloem.

DNA analysis should prove to be a valuable tool for investigating the existence of other plant hosts, possible insect vectors, and MLOs other than ash yellows MLOs which infect ash species.

Site Relationships

Ecological and vegetation studies have provided information about white ash stands affected by yellows and indicate the following:

- Ash yellows is more common in areas of mixed land use than in heavily forested areas and is often associated with understory plant species characteristic of exposed sites.

- Ash yellows symptoms in trees larger than saplings are most prominent in hedgerows and near the edges of woodlots. Ash saplings in the understory of stands affected by ash yellows often have brooms.

- Ash yellows can cause significant loss of volume growth in young stands. After tree crowns close in a young stand, the growth of trees with ash yellows diminishes markedly, and those with crowns in intermediate and suppressed positions eventually die.

- Ash yellows and drought may interact to amplify growth decline.

Many ash affected by yellows continue moderate growth until they come under stress from other factors such as drought and competition with neighboring trees.

Management

There is no known way to prevent or cure ash yellows. White ash that become infected when young do not grow to merchantable size. Most merchantable sized diseased ash trees live for at least 5-10 years. Management prescriptions which promote species diversity or stand conversion to species other than ash and reduce plant stresses from water shortage and competition should minimize growth losses associated with ash yellows.

Forests
Management of stands where ash yellows occurs should be aimed at gradual white ash stands, trees of this species that exhibit slow growth and dieback should be removed during regular harvests as follows:

- Harvest trees with greater than 50% crown dieback within 5 years.

- Remove other affected ash during subsequent harvests.

Home Landscapes
Managers of shade and ornamental trees should consider management strategies which:

- Remove trees with severe dieback, because they can not be rehabilitated.

- Promote species diversity in tree planting programs, and avoid monocultures of ash along city streets.

- Select tree species suitable to planting sites, and avoid planting ash in drought-prone sites.

- Encourage tree care practices that reduce plant stresses. Watering during drought and periodic fertilization to promote general tree health may be useful.

In the future, ash cultivars or rootstocks resistant to or tolerant of ash yellows may become available.

Key References

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